BIOREMEDIATION OF PETROCHEMICAL-CONTAINING SUBSTRATES USING FUNGI

PRIORITY CLAIMS

[0001] This application claims priority to U.S. Provisional Patent Application Ser. No. 62/655,276, filed Sep. 11, 2018, and PCT/US2019/050128, filed Sep. 9, 2019, the entire contents of which are incorporated herein by reference and relied upon.

FIELD OF THE INVENTION

[0002] The present disclosure provides methods and compositions for bioremediating petrochemical-containing construction scrap into biomass.

BACKGROUND OF THE INVENTION

[0003] Millions of tons of asphalt-including roofing materials are sent to landfills or incinerated each year, representing the fourth-largest volume of all construction and demolition waste streams. Due to high content of heavy metals and hydrocarbons, recycling and reuse options for these materials are limited, and many municipalities have banned or have implemented high fees to send asphalt- and/or PAH-containing materials to landfills. Existing recycling programs are not widely available and are costly to implement.

[0004] A need persists for economical, efficient and environmentally-friendly technologies for converting petrochemical-containing substrates.

BRIEF DESCRIPTION OF THE INVENTION

[0005] The present disclosure provides methods of bioremediating scrap material that contains petrochemicals, such as polycyclic aromatic hydrocarbons ("PAH") and asphalt. In some embodiments, the method comprises mixing the scrap material with fungal tissue to produce a bioremediated product.

[0006] In some embodiments, the present disclosure provides a method of bioremediating solid petrochemical-containing scrap material, the method comprising breaking down any such scrap that exceeds 1 cm in any dimension into pieces that measure between 1 mm and 1 cm in all dimensions; mixing the broken-down scrap pieces with a growth medium selected from the group consisting of sawdust, paper, hemp, straw, gypsum and cardboard to form a scrap-growth medium mixture; sterilizing the scrap-growth medium mixture, homogenizing the scrap-growth medium mixture; hydrating the scrap-growth medium mixture to a moisture content of 50-75%, inoculating the hydrated scrap-growth medium mixture with a saprotrophic fungus species selected from the group consisting of *Pleurotus* spp., *Ganoderma* spp., *Trametes* spp. *Schizophyllum* spp., *Irpex* spp. and *Lentinula* spp.; xposing the hydrated scrap-growth medium-fungus mixture to air, and incubating the scrap-growth medium-water-fungus mixture at a temperature of 60-80 F, pH range of 4-8 and moisture content of 50-75%.

[0007] In other embodiments, the present disclosure provides a composition comprising pieces of solid petrochemical-containing construction scrap material, growth medium selected from the group consisting of sawdust, paper, hemp, straw, gypsum and cardboard, air, water, a sterilizing agent and a fungus selected from the group consisting of *Agrocybe* spp., *Amanita* spp., *Armillaria* spp., *Auricularia* spp., *Cerrena* spp., *Coprinus* spp., *Cyathus* spp., *Daedalea* spp., *Daedaleopsis* spp., *Daldinia* spp., *Echinodontium* spp., *Exidia* spp., *Fistulina* spp., *Flammulina* spp., *Fomes* spp., *Grifola* spp., *Hericium* spp., *Heterobasidion* spp., *Hypsizygus* spp., *Inonotus* spp., *Lenzites* spp., *Marasmius* spp., *Phanerochaete* spp., *Pisolithus* spp., *Sparassis* spp., *Strobilomyces* spp., *Xylaria* spp., *Pleurotus* spp., *Ganoderma* spp., *Trametes* spp. *Schizophyllum* spp., *Irpex* spp. and *Lentinula* spp. These and other embodiments are described more fully in the following Detailed Description.

DETAILED DESCRIPTION OF THE INVENTION

[0008] The present disclosure provides methods of bioremediating pieces of petrochemical-containing scrap material using fungi, and bioremediating compositions comprising pieces of petrochemical-containing construction scrap, growth medium, air, water, a sterilizing agent, and a fungal culture.

1. Methods of Bioremediation

[0009] In general, methods consistent with the present disclosure comprise inoculating pieces of solid petrochemical-containing scrap material with a fungal culture in the presence of a growth medium, air, water and a sterilizing agent.

[0010] Asphalt is one example of a petrochemical that can be found in scrap. Non-limiting examples of asphalt-containing scrap include roofing shingles that include asphalt, pavement, blacktop, roofing shingles, built-up roofing including bitumen, interply of fiberglass and/or polyester, modified bitumen, rubberized asphalt, seal coat, fluid applied waterproofing, membrane waterproofing, asphalt-based coatings, asphalt coated materials, asphaltic mastics, asphalt impregnated felts, base sheets, interply adhesives, and other contaminated asphalt waste. In some embodiments, the solid scrap material comprises an asphalt-contaminated material, such as clay tile onto which asphalt has adhered, or a substrate onto which an asphalt mastic has been applied (e.g., sprayed).

[0011] Further examples of petrochemical-containing scrap material include an asphalt modifier, such as a filler, an extender, a rubber, a plastic, a rubber-plastic combination, a fiber, an oxidant, an antioxidant, a hydrocarbon, an antistripping agent, and/or a waste material. The filler may be, for example, a mineral filler, crusher fines, lime, portland cement, fly ash, and/or carbon black. The extender may be, for example, sulfur and/or lignin. The rubber may be, for example, natural latex, synthetic latex such as polychloroprene latex, a block copolymer such as styrene-butadiene-styrene (SBS), and/or reclaimed rubber such as SBR crumb rubber from used tires or flooring underlayment. The plastic may be, for example, polyethylene/polypropylene, ethylene acrylate copolymer, ethyl-vinyl-acetate (EVA), polyvinyl chloride (PVC), ethylene propylene, ethylene propylene diene monomer rubber, and/or a polyolefin.

[0012] The fiber may be, for example, a natural fiber such as asbestos and/or rock wool; or a manufactured fiber such as a polypropylene fiber, a polyester fiber, fiberglass, a mineral fiber, and/or a cellulose fiber. The oxidant may be, for example, a manganese salt. The antioxidant may be, for example, a lead compound, carbon, and/or a calcium salt.